FACTORS AFFECTING EXCHANGE RATE MOVEMENTS
IN SELECTED ASIAN COUNTRIES

by

Jerson B. Patosa¹ and Dr. Agustina Tan Cruz²
(09475292651)

Abstract

Exchange rate has a vital role in the country’s level of trade, which in turn is very critical in a free market economy. Consumer spending is specifically directly affected by money supply in the agribusiness sector, and vice versa. The main objective of this study is to determine the factors affecting movements in the exchange rate of selected Asian countries. The United States is taken as the base country. The real interest differential (RID) model, supported by the Keynesian and Chicago price theories, is used in the study. Data on money supply, industrial production, interest rate, and inflation rate were taken from the World Bank for the period 1977–2010. Both long- and short-run exchange rates were estimated using ordinary least squares (OLS). Results show that not all variables included in the model contribute to the explanation of exchange rate movements. Industrial production is significant in all countries. Results for other three variables money supply, interest rate and inflation rate are somewhat mixed. China, Malaysia, Thailand and Singapore have only two significant variables each. For China and Malaysia, the significant variables are industrial production and inflation rate. For Thailand industrial production and interest rate are significant and for Singapore money supply and industrial production. For the Philippines, three variables have significant contribution to the exchange rate movements, and these are money supply, interest rate and industrial production. Policy makers therefore must be aware of control mechanics so that movements of any determinants will not run adverse to the market mechanism.

Keywords: exchange rate movements, ordinary least squares, real interest differential model.

INTRODUCTION

Exchange rate is a very important factor affecting economic health. It has a vital role in country’s level of trade which in turn is very critical in a free market economy. Consumer spending particularly in the agri-business sector, it is directly affected by money supply and vice versa. This is the reason why exchange rate is the most monitored, analyzed and politically manipulated measures of the economy (wiki.answers.com). Like any other commodity, the value of the currency rises and falls depending on the forces of demand and supply. Consumer spending is directly affected by money supply and vice versa.

The supply and demand of the country’s money is reflected in its foreign exchange rate (www.tutor2u.net). The relative demand and supply of money in the country will determine the exchange rate between countries. A permanent increase of money supply in home country causes the exchange rate to depreciate. An increase in the home country interest rate causes the demand for money to decrease followed by an increase in the price level resulting in home country over foreign country exchange rate depreciation.
Likewise, an increase of interest rate in a foreign country causes the demand for money in that foreign country to decrease causing an increase in price level in said foreign country, and the home country over foreign country exchange rate will appreciate (wiki.answers.com).

The country import and export are also affected by the changes of exchange rate. An appreciation of home country currency will lead the price of export products to be more expensive, and import products to be cheaper. Likewise, a depreciation of home currency will lead the price of import products to be more expensive and export products to be cheaper.

From 1990 to 2010, the Philippine peso has the highest exchange rate based on the U.S dollar followed by the Thai baht, Chinese Yuan, Malaysian ringgit, and Singapore dollar in that order. The Philippine peso and the Thai baht exchange rate movements move in the same manner as we can see in Figure 1. On the other hand, movements of Chinese Yuan, Malaysian ringgit and Singapore dollar are almost similar, except for magnitude.

![Exchange Rate Movements](image)

Figure 1: Exchange rate movements in selected Asian countries: 1990-2010.

_Rationale of the Study_

The interest of this study is to investigate which factors really affect movements of the exchange rate. A real understanding of the mechanism behind the exchange rate movements has always been of great interest for economists around the world. As a consequence, studies were done about exchange rate but studies done in the Philippines are limited.

_Significance of the Study_

Movements in today’s exchange rate are affecting tomorrow’s exchange rate level and, thus, the Central Bank’s loss function. As is the case with price level stabilization, the forward-looking public understands that deviations from target will be countered by future policy movements. Consequently, this reduces the discretionary stabilization bias. The impact of exchange rate to the macroeconomic variables is an essential factor that policymakers should consider, aside from determining factors affecting exchange rate movements between countries. Moreover, this will help them in deciding what issues and policies are to be prioritized, especially in formulating the monetary as well as the fiscal policy.

_Objectives of the Study_

The main objective is to determine the factors affecting movements in the exchange rate of selected countries in Asia. The study aims to present trends of exchange rate movements in the Philippines, China, Singapore, Thailand and Malaysia. The United States is taken as the base country.
REVIEW OF RELATED LITERATURE

Using the Real Interest Rate model in identifying the determinants of exchange rate movements, Peterson (2005) confirmed that variables included in the model used to explain the changes in exchange rate are not uniform for countries. One country experiences a different economic situation compared to another country; hence the movements of exchange rate also differ, and so with the factors affecting them. The variables that seem to be the most in line with the original RID model among three countries (Japan, Sweden and UK) are interest rate differential and inflation rate. The result is somewhat unexpected for industrial production and money supply. The coefficient for money supply is negative instead of the expected positive sign. All three economies show this relation and results are also significant at one percent level. Due to a one percent decrease in money supply, exchange rate increases by 0.65 percent.

Hua (2011) showed the economic and social effects of real exchange rate. A real appreciation exerts positive effect on economic growth by exerting pressure on efficiency improvement and technological progress via worker’s motivation, education and capital intensity. It exercises negative effect by deteriorating the international competitiveness in tradable sector, and thus by destructing employment. He used the Generalized Moment Model (GMM) system estimation approach and panel data for 29 Chinese provinces, over the period 1987-2008. The study showed that the real exchange rate appreciation had a negative effect on the economic growth and is higher in coastal than in inland provinces, contributing to a minimization of the gap of GDP per capita between two kinds of the provinces. Also, the real exchange rate appreciation exhibited negative effects on employment.

Dorosh and Valdez (1990) quantify the effects of exchange rate and trade policies on agriculture in Pakistan. They found out that a trade policy bias to importable goods leads to an appreciation of the exchange rate, i.e., a decrease in the ratio of the domestic price of traded goods to non-tradable. The real exchange rate appreciates because tariffs on imports raise the domestic prices of import goods so that demand shifts to non-traded goods. The main finding of their paper is that there is a need to analyze the effects of policy interventions in agriculture in developing countries in an economy-wide framework. They also found that there is now an overwhelming body of evidence showing that trade and exchange rate had a greater adverse impact on agriculture incentives, than policies that are specific to agriculture. The indirect and usually implicit price intervention also influence private investment and labor employment in agriculture, and induce substantial income transfer from agriculture to the rest of economy.

Byrne and Davis (2003) estimate the impact of exchange rate uncertainty on investment, using panel estimation featuring a decomposition of exchange rate volatility derived from the GARCH model of Engle and Lee (1999). The key result of the study is that transitory and not the permanent component of exchange rate negatively affects investment. The permanent volatility will not delay investment as firms act to take advantage of related permanent shifts in the exchange rate, while a rise in temporary volatility will reduce investment as firms become more conservative under sensitive uncertainty and delay their investment. The results imply that to the extent that Economic and Monetary Union (EMU) favors lower transitory exchange rate, it will also be beneficial to investment (Byrne and Davis, 2003).

Aydin et al. (2004) estimates the export supply and import demand for the Turkish economy using both single equation and vector regression framework. The study indicated that imports are mostly affected by the real exchange rate and national income. The analysis reveals that the real exchange rate is a significant determinant of imports and trade deficit, but not of export. Exports are mostly determined by unit of labor cost, export prices and national income. The VAR finding that the real exchange rate is determined by current account indicates that the effect of the real exchange rate on trade deficit basically works through the imports. On the export side, as the unit of labor costs and export prices are basic determinants, public and private policy measures toward productivity increase should be taken into consideration.

Berument and Pasaogullar (2003) investigate the negative relationship between the real exchange rate and output in Turkey. They first analyzed the bivariate relationship between the set...
of the variables (interest rate, real exchange rate, government size, inflation rate, output, capital account and current account). They also analyzed whether a long-run relationship exist between the real exchange rate, inflation rate and output. Several VAR models were estimated, and the forecast error variance decomposition and impulse responses obtained from the VAR models were examined. In the bivariate analysis, for most of the transformations and lags, they found a negative correlation between output and real exchange rate. However, from the Granger causality test, they did not find a significant causality between the variables, possibly due to the inability of the test to remove the effects of other exogenous variables. They also found that a long-run relationship exists among the real exchange rate, inflation rate and output. After employing various VAR models for the sample period (quarterly data from 1987-2001), they found out that real exchange rate movements are very important in the variability of output. The response of output is negative and permanent after a real devaluation. Their findings also hold in the alternative settings in which the possible effects of external variables are controlled.

Kamin and Roger's (2000) study in Mexico suggest that to limit the detrimental effects of devaluation, the overvaluation of a currency must be prevented. Further, they claim that there is no easy way to keep output costs at moderate levels after devaluation. An overvalued domestic currency may initially result in increased output but may create the risk of a financial crisis, which in turn, may cause exchange rate depreciation and subsequent output losses.

**METHODOLOGY**

**Theoretical Framework**

The Keynesian theory and the Chicago price theory are the theories supporting the RID model developed by Jeffrey A. Frankel in 1979. Keynesian theory is a general theory of employment, interest and money. Keynesianism is named after John Maynard Keynes, a British economist who lived from 1883-1946. Keynesians believe that prices and wages are not flexible but are sticky, downward. The stickiness of prices and wages in the downward direction prevents the economy's resources from being fully employed.

Another theory used by Frankel is the Chicago price theory formulated by Milton Friedman in 1976 and George Stigler 1982, supported by the Department of Economics, Chicago University. This theory assumes that prices and wages are flexible; a contradiction to Keynesian theory. It is based on the premise that answering important economic questions correctly requires the ability to combine theory and data. Peterson (2005) used the Chicago price theory and included the money supply, industrial production, interest rate and inflation differential to explain the movements in the exchange rate between countries.

The Frankel RID model tested the Deutche Mark/US dollar rate between the years 1974-1978 and found that the model helped explain over 80 percent of the Frankel RID model exchange rate variations between the US and Germany. The model receives great enthusiasm around the world for its ability to predict exchange rate movements to a larger extent. Many economists have re-evaluated the model and tested it in different time periods. However, support for the model after the 1980’s has been rather poor. In the study of Isaac and de Mel (1999) they concluded that the Frankel’s validation of the RID model was pure historical accident. But in the study of Peterson (2005), it was found that the model seems to be able to explain movements in the exchange rate to a certain degree up to the present.

The model has the Purchasing Power Parity (PPP) and the Uncovered Interest Rate Parity (UIRP) as underlying theoretical assumptions, the two main building blocks of open macroeconomics. When combined, the PPP and UIRP offer a relationship between changes in exchange rate and the interest rate. Peterson (2005) also claimed that the model constitutes significant explanatory variables (money supply, industrial production, interest rate and inflation rate) for exchange rate movements in all countries included in his study. This study seeks to find out if the variables used in the model of Peterson (2005) can help identify exchange rate movements in Asian countries with the US economy as the base.

**Conceptual Framework**

Figure 2 shows the conceptual framework of the study. The identified economic variables that can affect the exchange rate movements are: money supply, industrial production, interest rate and inflation rate. The variables in this study are the same with those of Peterson (2005).
The exchange rate movements are hypothesized to be affected by money supply, industrial production, interest rate and inflation rate. Of the four economic variables, the interest rate and inflation rate are generally viewed as standard determinants of exchange rate movements. Peterson (2005) found that these variables seem to be the most influential factors in his original RID model.

The domestic currency price of the foreign currency is one of the many prices in the economy that rises in the long-run after a permanent increase in the money supply. A permanent increase in a country’s money supply causes a proportional long-run depreciation of its currency against foreign currencies. Similarly, a permanent decrease in a country’s money supply causes a proportional long-run appreciation of its currency against foreign currencies (Krugman and Obstfeld, 2006). A country with a consistently lower inflation rate exhibits a rising currency value, as its purchasing power increases relative to other currencies. Those countries with higher inflation typically see depreciation in their currency in relation to the currencies of their trading partners. This is also usually accompanied by higher interest rates. Interest rate is determined by the money market. Higher interest rates offer lenders in an economy a higher return relative to other countries. Therefore, higher interest rates attract foreign capital and cause the exchange rate to rise. The impact of higher interest rates is mitigated, however, if inflation in the country is much higher than in others, or if additional factors serve to drive the currency down (www.investopedia.com). A rise in domestic industrial production or output level raises domestic money demand leading by the fall in the long-run domestic price level. According to the PPP model there is an appreciation of the domestic currency against foreign currencies. A rise in foreign output raises foreign money demand, leading to a fall of foreign price level in the long-run.

**Purchasing Power Parity**

For the RID model to hold, Purchasing Power Parity (PPP) must also hold. PPP is a generalization of the law of one price, which states that two identical goods must sell for the same price when converted into the same currency. PPP states that the general price level should be the same when converted into a common currency.

The PPP equation is expressed as:

\[ \frac{P_d}{P_f} = x \]  (1)

where:

- \( P_d \) = domestic price level
- \( x \) = spot exchange rate
- \( P_f \) = foreign price level

Reasons for PPP failure are sticky prices, the existence of non-traded goods and the fact that the basket of goods used in different countries may differ according to taste and other social factors. For absolute PPP to hold the real exchange rates which have to be floating should be equal to one.

In practice, absolute PPP is not very likely to hold (Copeland, 2005). However, relative PPP can help explain movements in the exchange rate. This hypothesis states that when the domestic currency experiences higher inflation, there must be an equal fall in the value of the

Figure 2: Factors affecting exchange rate movements in selected Asian countries with the United States as the base.
home country’s currency. According to Copeland (2005) inflation in the home country is equal to the foreign country’s inflation rate plus the percent depreciation. Similarly, home country’s inflation can only be higher to that of the foreign if its currency depreciates by the same percentage.

**Uncovered Interest Rate Parity**

The second underlying theory is Uncovered Interest Rate Parity (UIRP), which states that when the domestic interest rate is higher than that of foreign, there must be a compensated depreciation of the home currency.

The UIRP equation is written as:

\[ r_d = r_f + d_p \]  

where:

- \( r_d \) = domestic interest rate  
- \( r_f \) = foreign interest rate  
- \( d_p \) = the expected percent depreciation of the domestic currency

If the domestic country’s currency is expected to depreciate and hence, lose value, no domestic or foreign agents will hold domestic assets unless they offer a higher interest that compensate for the lower value of the currency. UIRP assumes that economic agents are risk neutral. They do not require a risk premium when undertaking risky investments. In other words, they are indifferent between holding risky assets or not and hence, they only care about the average return (Copeland, 2005)

**The Model**

The model was developed by Frankel (1979) using different approaches regarding the relationship between the interest rate and exchange rate. The first approach assumes a flexible price and is referred to as the Chicago theory. The flexible price assumption implies a positive relation between the interest rate and the real exchange rate. This is explained by the fact that when the domestic interest exceeds that of the foreign, the domestic currency is expected to experience depreciation and inflation in the near future. This in turn causes demand for domestic currency to fall with depreciation as a consequence. Hence, we have a positive relationship between the interest rate and the exchange rate. The second model involves the RID model assuming sticky prices, and is called the Keynesian theory. This theory has a negative relationship between the exchange rate and interest rate. With the domestic interest higher than foreign because of a reduction of the domestic money supply, but without a fall in the price since prices are sticky, capital inflow is increasing. This will in turn lead to an appreciation of the domestic currency.

With the two underlying theories explained, the basic assumptions for the RID model can be revealed. The RID model is considered a combination of the Chicago theory with flexible price and the Keynesian theory with stickiness in the sense that it has a negative relation between the exchange rate and the interest differential, but a positive relation regarding the exchange rate and the long-run expected inflation differential (Frankel, 1979).

**Long run exchange rate:**

The long-run exchange rate could be expressed in the following form:

\[ \Delta e = \phi (y_d - y_f) + \lambda (\bar{y}_d - \bar{y}_f) \]  

where:

- \( \Delta e \) = change in the exchange rate  
- \( \phi \) = elasticity of demand for domestic goods  
- \( \lambda \) = elasticity of substitution  
- \( y_d \) = domestic output  
- \( y_f \) = foreign output  
- \( \bar{y}_d \) = domestic long-run output  
- \( \bar{y}_f \) = foreign long-run output

These equations represent the long-run exchange rate and the interest rate differentials.
\( m = \text{natural log of money supply} \)
\( p = \text{natural log of the price level} \)
\( y = \text{natural log of real output} \)
\( r = \text{interest rate} \)
\( x_s = \text{short-run exchange rate} \)
\( x_l = \text{long-run exchange rate} \)
\( \varphi = \text{parameter representing intercept term} \)
\( \lambda = \text{speed of mean-reversion} \)
\( d = \text{indicates the analogous variables for the domestic country} \)
\( f = \text{indicates the analogous variable for the foreign country} \)
\( * = \text{indicates the analogous variable for the long-run} \)

It follows that an increase in the domestic money supply causes the price to go up and hence, the exchange rate to depreciate. An increase in income or a fall in the expected price increases the demand for money and therefore causes the currency to appreciate.

**Short run exchange rate**

Assume UIRP and relative PPP, \( x = p_d - p_f \) to hold, and also \( \dot{e}_d = \theta (x_l - x_s) + \lambda (l_d - l_f) \), where \( \theta > 0 \) is the speed of adjustment (the greater the gap between the spot and long-run exchange rate, the faster is the percent change in the exchange rate). By combining the UIRP and PPP, we come up with equation 4, which demonstrates the short run exchange rate.

\[
\begin{align*}
  r_d - r_f &= \theta (x_l - x_s) + \lambda (l_d - l_f) \\
  x_s &= x_l - \frac{r_d - r_f}{\theta} - \lambda (l_d - l_f)
\end{align*}
\]

where:
- \( \theta = \text{speed adjustment} \)
- \( r_d = \text{domestic exchange rate} \)
- \( r_f = \text{foreign exchange rate} \)
- \( l_d = \text{domestic inflation rate} \)
- \( l_f = \text{foreign inflation rate} \) and other variables are as defined in equation (3)

**Real Interest Parity**

In the long run, \( x_l = x_s \); hence:

\[
r_d - r_f = l_d - l_f.
\]

This is known as “Real Interest Parity”, a combination of UIRP and PPP. It states that the interest rate differential is equal to the inflation differential.

**Real Interest Differential Model**

Combining equations (3) and (5), we have:

\[
\begin{align*}
x_s &= m_d - m_f - \varphi (y_d - y_f) + \lambda (l_d - l_f) \\
y_d &= y_d; y_f = y_f; m_d = m_d; \\
m_d = m_f; r_d = r_f \text{ and } r_f = r_f
\end{align*}
\]

where:
- \( m = \text{money supply differential as percent of GDP} \)
When combining equation 6 with the short run conditions of equation 4, we end up with equation 7 below:

\[ x = m_d - m_f - \varphi (y_d - y_f) - \frac{1}{2} \left( r_d - r_f \right) + (\lambda + \frac{1}{2}) (I_d - I_f) \]  

where:
- \( x \) = spot exchange rate
- \( b \) = speed of adjustment

The model describes the exchange rate as a function of the relative money supply, the relative income level, the interest differential and the inflation differential. In the short run, the exchange rate's speed of adjustment is proportional to the size of the gap between the spot exchange rate and the long run exchange rate, and in the long run, when \( x = x_p \) by the inflation rate. This can be tested by estimating to see whether or not it can help explain any of the variation of the exchange rate with appropriate signs on the coefficient estimates. The final model, which serves as the empirical model of the study is then expressed as:

\[ x = \beta_0 + \beta_1 (m_d - m_f) + \beta_2 (y_d - y_f) + \beta_3 (r_d - r_f) + \beta_4 (I_d - I_f) + \varepsilon \]  

where the variables are as previously defined.

**Data and Variables**

The data were gathered from the World Bank website. The following variables were considered:
(a) Money supply – the total amount of money available in an economy at specific time (M2).
(b) Industrial production – a measure of the county’s economic health judged by its output from manufacturing, mining and utility industries, proxied by real GDP.
(c) Inflation rate – the percentage rate of change in price level over time.
(d) Interest rate – the rate at which interest is paid by a borrower for the use of money that they borrow from a lender.

**Empirical Application**

This section presents the model for the real interest differential theory. Equation 8 is used to test which variable affects the exchange rate movements in selected Asian countries (Philippines, China, Singapore, Malaysia, and Thailand) with the United States as the base.

This study determined the factors affecting exchange rate movements in selected countries in Asia during the years 1977-2010. Ordinary least square (OLS) and the unstandardized coefficients have been used to estimate the model (Frankel 1979). In order for the estimation of the parameters to be BLUE (Best Linear Unbiased Estimator) the following conditions are to be satisfied:

(i) Each random error has a probability distribution with zero mean. Some errors will be positive that is; \( E (t) = 0 \)

(ii) Each random error has a probability distribution with variance of \( \sigma^2 \), \( E (\varepsilon^2) = \text{var} (\varepsilon) = \sigma^2 \).

(iii) The covariance between the two random errors corresponding to any two different observation is zero; \( \text{cov} (\varepsilon_i \varepsilon_j) = 0 \) where ,
The primary objective of the monetary policy of the “Bangko Sentral ng Pilipinas” (BSP) is to promote a low and stable inflation rate, and price stability conducive to a balanced and sustainable economic growth. Inflation target is defined in terms of the average year-on-year change in the consumer price index (CPI) over the calendar year. The inflation target is set at 4.5 percent with a tolerance interval of plus 1.0 percent point for 2010 and 4.0 percent with a tolerance interval of plus 1.0 percentage point for 2011 (www.tradechakra.com). The BSP has a number of monetary policy instruments at its disposal to promote price stability. To increase or reduce liquidity in the financial system, the BSP uses open market operations, accept fixed-term deposits, offers standing facilities and requires banking institutions to hold reserves on deposits and deposit substitutes. The reason for having low inflation as the monetary goal is based on the fact that theory and practical experience indicate that high inflation causes social cost, while a low inflation makes a ground for a stable economic growth (www.psb.gov.com).

Estimates of Parameters: Philippines

Table 1 shows that industrial production, money supply and inflation rate are the significant variables. The exchange rate elasticity with respect to industrial production is -0.479, implying that a 1 percent increase in the industrial production causes the Philippine exchange rate to depreciate by 0.479 percent. This jibes with the study of Berument and Pasaogullar (2003) where the correlation of exchange rate and output is negative. A permanent increase of money supply in the home country causes the exchange rate to decrease.

The estimated coefficient of money supply is -0.392, indicating that a 1 percent increase in the money supply causes the Philippine exchange rate to decrease by 39.2 percent. Based on macroeconomic theory, an increase in money supply causes a decrease in interest rate followed by an increase in investment and consumption. Aggregate demand will increase, and consequently, the demand for money will increase. As a result, demand for peso will increase. Only the interest rate is not significant and this means that movements of exchange rate in the Philippines are not affected by the changes of this variable.

Table 1. Estimates of coefficients – RID model for the Philippines, 1977-2010.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Deviation</th>
<th>P-Value</th>
<th>Partial Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.121*ns</td>
<td>2.003</td>
<td>2.003</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>-0.392*</td>
<td>0.189</td>
<td>0.046</td>
<td>-0.360</td>
</tr>
<tr>
<td>Industrial production/real GDP</td>
<td>-0.479*</td>
<td>0.070</td>
<td>0.000</td>
<td>-0.787</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.329*</td>
<td>0.146</td>
<td>0.032</td>
<td>0.787</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.706*ns</td>
<td>0.638</td>
<td>0.277</td>
<td>0.202</td>
</tr>
</tbody>
</table>

R² adjusted = 60.79,
* = Significant at 10% level
ns = Not significant

By squaring the partial correlation value, we can get how much each independent variable is contributing to the dependent variable. Industrial production has a partial correlation value of -0.787 which gives 0.619 and hence, explains 61.9 percent of the exchange rate variability. Money supply differential explains 19.9 percent, inflation rate differential explains 14.9 percent and the interest rate differential only 4.08 percent.

Figure 7 shows the actual and predicted exchange rate values of Philippine peso based on the U.S. dollar. Both predicted and actual data follow the same trend. The differences between
the predicted and actual data are quite small, indicating the capability of the RID model to predict exchange rate. As we can see in the graph, the Philippines exchange rates rapidly increase in 1997 due to the Asian economic and financial crisis. All Asian countries considered in this study were affected by the crisis (Das, 1999).

![Graph of exchange rates](image)

Figure 7. Actual and predicted exchange rate, Philippine peso: U.S. dollar, 1977-2010.

Exchange rate of the Philippines rapidly increase from 2000 to 2004, it was in the year 2000 that the investors dumped their holdings due to the allegations of Ilocos Sur Gov. Luius “Chavit” Singson that President Estrada received payoffs from illegal gambling operations or jueting. The economy also suffered from wage and transport cost increases that lead investors to cut their investments. In this year also, the Philippines stock market has lost around 36 percent of its value since the start of that year (www.newsflash.org).

**China**

In China, the People’s Bank of China (PBC) formulates and implements monetary policies, the goal of which is to maintain the stability of the value of currency and thereby promote economic growth. In addition, financial supervision is another important function of the PBC. The PBC approves, supervises and administers financial institutions and financial markets and publishes financial and business laws and rules. The goal of PBC’s financial supervision is to maintain a stable and sound financial industry (www.pbc.gov.com).

Table 2 shows the regression results for China. Inflation rate differential and industrial production got the expected signs that support the underlying assumption of the model. $R^2$ adjusted is equal to 68.50 percent indicating the contribution of the two variables in forecasting exchange rate. The exchange rate elasticity with respect to the industrial production is -0.635, representing a 0.635 percent decrease in China’s exchange rate as industrial production increases by 1 percent.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Deviation</th>
<th>P-Value</th>
<th>Partial Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-4.935$^{ns}$</td>
<td>4.677</td>
<td>0.300</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>0.437$^{ns}$</td>
<td>0.115</td>
<td>0.708</td>
<td>0.070</td>
</tr>
<tr>
<td>Industrial production/real GDP</td>
<td>-0.635*</td>
<td>0.088</td>
<td>0.000</td>
<td>-0.801</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.267*</td>
<td>0.128</td>
<td>0.047</td>
<td>0.359</td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.014^ns</td>
<td>0.038</td>
<td>0.724</td>
<td>0.066</td>
</tr>
</tbody>
</table>

\[ R^2 \text{ adjusted} = 68.50 \]

* = Significant at 10% level,
^ns = Not significant

The estimated coefficient of inflation rate differential is 0.267, implying that a 1 percent increase in inflation rate causes the exchange rate to appreciate by 26.7 percent. Money supply and interest rate are not significant, which means that the movements in exchange rate are not affected by the money supply and interest rate, as far as China is concerned.

Actual and predicted exchange rate values are presented Figure 8, which shows an increasing trend during the period 1977 to 2010. The rapid increase of China’s exchange rate in 1995 was accompanied by a high inflation rate of China.

In the same year the Chinese authorities abolished the exchange rate controls on current account transactions (exporting, importing, interest and dividends) and unified the exchange rate. From 1994 to 2004, China fixed their exchange rate (Mckinnon and Schnabl, 2009).

Malaysia

The Central Bank of Malaysia has two main monetary policy goals: the low inflation rate and the stable exchange rate. The contribution of these goals to the growth and development of Malaysia is often stressed because a stable exchange rate will conflict with the low and stable inflation rate. This conflict will occur if it leads to inappropriate setting of policy interest rate or if the exchange rate directly transmits foreign prices in an inflationary or deflationary fashion (wiki.answers.com).

Prior to the 1997 Asian financial crisis, the Malaysian ringgit was an internationalized currency, which was freely traded around the world. Just before the Asian crisis in July, 1997, the Ringgit was traded at 2.50 to the dollar. Due to speculative activities, the Ringgit fell as much as 4.10 to the dollar in matter of weeks. Bank Negara Malaysia, the nation’s central bank decided to impose capital controls to prevent the outflow of the Ringgit in the open market. The fixed change rate was abandoned in favor of the floating exchange rate in July 2005; hours after People’s Republic of China announced the same move. The Ringgit continued to strengthen to 3.18 to the US dollar in March 2008. Meanwhile, many aspects of the capital control has been slowly relaxed by Bank Negara Malaysia. However, the government continued not to internalize the ringgit (en.wikipedia.org).
Table 3 shows the regression results for Malaysia. The $R^2$ adjusted value of 0.6539 is quite comparable to those of the Philippines and China. The result implies that 65.39 percent of the variability in the exchange rate is explained by the independent variables included in the model. Figure 9 shows the capacity of the model to predict the exchange rate. Industrial production has the largest contribution in explaining the exchange rate movements.

Of the variables included, industrial production and inflation rate are significant. Exchange rate elasticity with respect to the Malaysia industrial production is -0.615, indicating that 1 percent decrease in industrial production causes the Malaysian exchange rate to depreciate by 0.615 percent. Money supply and interest rate differentials are not significant which means that movements of exchange rate in Malaysia are not affected by the two variables.

Figure 9 shows the actual and predicted exchange rate values of Malaysian ringgit with the US dollar as the base. The movements of actual and predicted exchange rate values are almost constant from 1977 to 1989 but from 1989 to 2010, the big differences between the two values occurred.

Policy in Malaysia has taken as one of its goals some form of exchange rate stability. This goal can at times come into conflict with the goal of low and stable inflation. Exchange rate stability can conflict with the goal of low and stable inflation rate if it leads to inappropriate setting of policy interest rates or if the exchange rate directly transmits foreign prices in an inflationary or deflationary fashion.

From September 1998 to July 2005, Malaysia opted for bilateral exchange rate stability against the US dollar that caused a rapid increase of Malaysian ringgit. Malaysia abandoned its commitment to bilateral exchange rate stability in favour of a commitment to effective exchange rate stability on July 21, 2005 (McCauley, 2007).

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Deviation</th>
<th>P-Value</th>
<th>Partial Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.533*</td>
<td>1.161</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>-0.035ns</td>
<td>0.111</td>
<td>0.758</td>
<td>-0.057</td>
</tr>
<tr>
<td>Industrial production/real GDP</td>
<td>-0.615*</td>
<td>0.092</td>
<td>0.000</td>
<td>-0.778</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.742*</td>
<td>0.364</td>
<td>0.050</td>
<td>0.353</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-0.018ns</td>
<td>0.040</td>
<td>0.668</td>
<td>0.080</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 65.39,

* = Significant at 10% level,

ns = Not significant
Thailand's monetary policy is similar to that of Malaysia. The main objective of Bank of Thailand (BOT) is to have low inflation and exchange rate stability. The reason for exchange rate stability is to promote export to uphold price stability in order to support economic growth. It can be recalled that the Asian financial and economic crisis started in Bangkok on the night of July 2, 1997.

Regression results are presented in Table 4. The value of $R^2$ adjusted is 0.3419, implying that only 34.19 percent of the variability of exchange rate are explained by the variables included in the study. The capacity of the model to forecast the movements of exchange rate are shown in Figure 10. Industrial production is significant and it has the biggest contribution when explaining the model. If the industrial production of Thailand decreases by 1 percent, exchange rate will increase by 0.834 percent. The Chicago price theory supports the positive relation between exchange rate and interest rate. The estimated coefficient of interest rate is 0.123 following that a 1 percent increase in the interest rate causes the exchange rate to increase by 12.3 percent. The remaining two variables (money supply and inflation rate differential) are not significant.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Deviation</th>
<th>P-Value</th>
<th>Partial Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.219&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>11.159</td>
<td>0.199</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>-0.342&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>2.513</td>
<td>0.893</td>
<td>-0.025</td>
</tr>
<tr>
<td>Industrial production/real GDP</td>
<td>-0.834&lt;sup&gt;*&lt;/sup&gt;</td>
<td>0.196</td>
<td>0.000</td>
<td>-0.621</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>-0.146&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>3.433</td>
<td>0.966</td>
<td>0.008</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.123&lt;sup&gt;*&lt;/sup&gt;</td>
<td>0.069</td>
<td>0.080</td>
<td>0.318</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 34.19,

<sup>*</sup> = Significant at 10% level,

<sup>ns</sup> = Not significant
During the Asian crisis in 1997 to 1998, the Thai baht devalued from 25 to 40 to the dollar, causing a temporary rise in inflation.

Figure 10. Actual data and predicted exchange rate, Thai baht: U.S. dollar, 1977-2010.

Singapore

Singapore aims to ensure low inflation as a sound basis for sustainable economic growth. Monetary policy is centered on the management of the exchange rate, rather than on the money supply or interest rate. This is a reflection that Singapore is a small and open economy. The exchange rate is the most effective tool in maintaining price stability of the place (Parrado, 2004).

The Monetary Authority of Singapore (MAS) manages the Singapore dollar exchange rate against a trade-weighted basket of currencies of Singapore major trading partners and competitors. The composition of this basket is reviewed and revised periodically to take into account changes in Singapore trade patterns. Monetary policy is reviewed on a semi-annual basis to ensure that it is consistent with the economic fundamentals and market conditions, thereby ensuring low inflation for sustained economic growth over the medium term (Parrado, 2004).

In the context of Singapore’s open capital account, the choice of the exchange rate as the focus of monetary policy would necessarily imply that domestic interest rates and money supply are endogenous. As such, MAS money market operations are conducted mainly to ensure that sufficient liquidity is present in the banking system to meet banks demand for reserve and settlement balances (wiki.answers.com)

Table 5 shows the regression results for Singapore where both money supply and industrial production are significant.


<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Estimated Coefficient</th>
<th>Standard Deviation</th>
<th>P-Value</th>
<th>Partial Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>16.328*</td>
<td>6.114</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>0.379*</td>
<td>2.109</td>
<td>0.083</td>
<td>0.316</td>
</tr>
<tr>
<td>Industrial production/real GDP</td>
<td>-0.125ns</td>
<td>0.126</td>
<td>0.000</td>
<td>-0.880</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.282ns</td>
<td>2.595</td>
<td>0.914</td>
<td>0.020</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-0.039ns</td>
<td>0.039</td>
<td>0.320</td>
<td>0.185</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 78.67,
The $R^2$ adjusted value of 78.67 percent is the highest value of all countries included in this study. In the case of Singapore, the differences between actual and predicted exchange rate are quite small, indicating that the model can forecast the movements of exchange rate well (see Figure 11). Squaring the partial correlation reveals that industrial production explains 77.4 percent of the exchange rate and money supply only, 9.10 percent. The exchange rate elasticity with respect to industrial production is -0.125, implying that a 1 percent increase in industrial production causes the Singapore exchange rate to depreciate by 0.125 percent.

Figure 11 presents the actual and predicted exchange rate values from 1977 to 2010. Both actual and predicted data follow the same trend. The downward trends of Singapore exchange rate indicating a strong local currency against foreign currency (US dollar). Exchange rate began appreciating in 1983 to 1985. This was followed by a depreciation that lasted till the end of 1996. The onset of the economic crisis is affected Singapore exchange rate to depreciate against US dollar. Appreciation began in early 2003, and this rise of the Singapore dollar has continued to the present.

Figure 11. Actual data and predicted exchange rate, Singapore dollar: U.S. dollar, 1977-2010.

Summary and Conclusion

This study determined the factors affecting exchange rate movements in selected Asian countries (Philippines, China, Malaysia Thailand and Singapore). It also presented trends and investigated the determinants of exchange rate movements in these countries with the United States as the base country. Data were gathered from the World Bank website. The Real Interest Differential (RID) model was used in this study to determine the factors affecting exchange rate movements in selected Asian countries.

Industrial production or GDP has a negative coefficient sign in the RID model, indicating that when the amount of industrial production increases, the local currency appreciates. This is true for all five countries in the study. A rise in domestic industrial production or output level raises domestic money demand leading by the fall in the long-run domestic price level. According to the PPP model there is an appreciation of the domestic currency against foreign currencies. A rise in foreign output raises foreign money demand, leading to a fall of foreign price level in the long-run.

In general, macroeconomic theory states that there is a negative trade-off between the real exchange rate volatility and interest rate differential (Krugman and Obstfeld, 2006). By controlling supply and demand for money through changes in the interest rate, a Central Bank
can stabilize the exchange rate. Both Singapore and Malaysia reveal this relation, though the values were not significant.

The significant variables in each country vary. Industrial production is significant in all countries. A decrease in money supply causes a decrease in interest rate and increase in investment and consumption in the Philippines. This is an important input to people in agric-business sector especially that we are in the agricultural country.

The results of this thesis show that not all variables included in the model contribute to the explanation of exchange rate movements. The significant variables in every country are not the same. The variables that seem to be the most in line in with the original RID model among the five countries are the industrial production. Results for the other three variables, money supply differential, interest rate differential and inflation rate differential are somewhat mixed. China, Malaysia, Thailand and Singapore have only two significant variables each. For China and Malaysia, the significant variables are industrial production and interest rate and inflation rate differential. For Thailand industrial production and interest rate differential are significant and for Singapore money supply and industrial production. For the Philippines on the other hand, three variables have significant contribution to exchange rate movements, and these are money supply differential, industrial production and inflation rate differential.

Areas for Further Research

Based on the results of the study the following areas are recommended for future study:

1. Include as many countries as there are available data. If possible, the country should be grouped such that one group is affected by a common global phenomenon (e.g. Economic crisis, natural disaster, etc.)
2. Include other variables in addition to what this study considered. For example, we can incorporate political stability and weather conditions in the estimation process.
3. Consider other models, and compared the results with those of the RID’s.
4. Include time as one of the factors, i.e., have a time-varying estimation of exchange rate movements.

BIBLIOGRAPHY


Byrne, J. P and E. P. Davis 2003.“Panel Estimation of the Impact of Exchange Rate Uncertainty on Investment in the Major Industrial Countries.”


